
FEDERAL INTERAGENCY COMMITTEE ON INDOOR AIR QUALITY (CIAQ)

Wednesday, October 23, 2002, Quarterly Meeting Minutes

Welcome & Introductions

Mary Smith, Director, Indoor Environments Division, EPA. Members and guests introduced themselves.

Department & Agency Updates (CPSC, NIST, NIOSH, DOE, HUD, EPA)

CPSC - Consumer Product Safety Commission, Lori Saltzman and Treye Thomas

Candlewicks. Working on banning the use of candlewick metals with more than 0.06% lead by weight as well as candles containing these wicks.

Booklets. CPSC is looking for partnerships to create the following booklets:

1. Arts and crafts booklet detailing appropriate materials that can be used in the classroom. This book will be targeted for schools.
2. School lab chemical guide update. The last update to this booklet was in the late 1970s.

Smoke Alarms. CPSC is performing smoke alarm tests on a 2-story home in North Carolina and a pre-manufactured home on NIST campus. These tests include determining concentrations of irritant and asphyxiant gases and estimating effects of irritant gases on egress time. For more information on test results, visit www.smokealarm.nist.gov.

NIST - National Institute of Standards and Technology, Andy Persilly and Cindy Howard Reed

BASE Ventilation Data. National Institute of Standards and Technology (NIST) continues to analyze ventilation data collected as part of the EPA BASE study of 100 office buildings. NIST is focusing on outdoor air intake rates, supply airflow rates and how building factors affect these rates.

Study of Hybrid Ventilation. With Department of Energy and Air-Conditioning and Refrigeration Technology Institute funding, we are continuing a simulation study to examine the performance of natural and hybrid ventilation systems in U.S. office buildings. NIST is performing airflow simulations to look at issues of ventilation reliability, air distribution, outdoor air quality impacts, and energy.

HUD projects. NIST is continuing a number of projects funded by the Healthy Homes Initiative and the Office of Policy Development and Research:

1. Defining a set of residential buildings that represent the U.S. residential housing stock.
2. Modeling of indoor contaminant sources, focusing on moisture, cooking, and other activities.
3. Developing a database of IAQ modeling inputs including source strengths, deposition rates, and filter efficiencies.
4. Studying airflow and contaminant transport from attached garages in single-family residences.
5. Continuing a long term study of moisture transport and the ability to predict indoor moisture levels in an occupied townhouse.

IEQ Performance Metrics. NIST started a project to investigate development of metrics to quantify indoor environmental conditions— specifically, what has been proposed, how they could be used, are we ready yet, and what work needs to be done. As a first step, a workshop on the subject was held at the ASTM meeting in Norfolk, VA, last week. There were about 30 attendees from academia, industry, consulting firms, and federal and state agencies. Discussions at the workshop generated several good ideas for follow-up activities including the following types of metrics that we may be ready to pursue: a rating scheme for building

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design/operation/maintenance, standardized or reference buildings and exposure scenarios, and measured concentration (IAQ) metrics based on existing work.

NIST Test House. NIST is testing a new double-wide manufactured test house on the NIST campus. NIST is currently focusing on establishing its airtightness and ventilation characteristics, and have developed a CONTAM model of the building. NIST will conduct studies of mechanical ventilation, air cleaning, VOC emissions from building materials, and residential moisture issues.

ASHRAE STANDARD 62. Four addenda will be released for public comment this fall: 62g, on separation of smoking and nonsmoking spaces; 62h, on the alternative IAQ Procedure for ventilation system design; 62n, on the Ventilation Rate Procedure for determining design outdoor air intake rates; and 62y, on limitations of recirculating air from certain space types to others. The committee has recommended publication of three new addenda: 62r, which requires outdoor air quality assessments and filtration when outdoor particulate concentrations are elevated; 62z, which requires air cleaning when outdoor ozone levels are elevated; and 62ad, which updates an informative appendix on contaminant concentration guidelines issued by other bodies. These recommendations to publish will be acted on by the ASHRAE Standards Committee and Board of Directors when they meet in Chicago in January. For more information, contact Andy Persily at 301-975-6418 or andyp@nist.gov.

The 62.2P committee met via conference call in August to complete responses to the 3rd public review comments and to complete the 4th public review draft of the standard. The revised draft standard has been approved for public review by ASHRAE. Technical changes to the 3rd PR draft include kitchen and bathroom fans for intermittent use must meet three zone ratings, clarification that appliance-hood combinations qualify as range hoods, and clarification that a back draft test is not required for solid fuel equipment. Also, the committee began work on a companion guideline to standard 62.2P. A public review for the title purpose and scope of Guideline 24P has been completed with no comments received. This guideline will provide information on achieving good IAQ in residences and may go beyond the minimum requirements of the standard. For more information, contact Steven Emmerich at 301-975-6459 or steven.emmerich@nist.gov.

AIHA has just issued a draft standard on IAQ for public comment. If you are interested, you can order a copy from AIHA. If you need help finding out where to obtain a copy, contact Andy Persily.

NIOSH - The National Institute for Occupational Safety and Health, Matt Gillen

The *American Journal of Public Health* published NIOSH's research agenda titled "Improving the Health of Workers in Indoor Environments: Priority Research Needs for a National Occupational Research Agenda," in their September 2002 issue. This research agenda includes numerous tables that highlight the main findings in the paper. The first table reviews the estimated health impacts of contaminants in indoor work environments in the United States. The table details the contaminant-related health effects; the number of workers with health effects due to work exposure; severity, frequency, and estimate potential annual reduction in health effects from improved work environments among indoor workers. The second table details the estimated annual economic impacts of contaminant-related health effects in indoor work environments. This table includes the health care costs of effects due to work exposure. These numbers were hard to come up with but NIOSH performed extensive research which resulted in these numbers. Other tables in the report detail the priority research needs, barriers, and incentives to improving health of U.S. workers. A detailed list of resources is located at the back of the paper.

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DOE - Department of Energy, Terry Logee

Consensus Standards. On August 12, the project committee voted for a fourth public review of ASHRAE Standard 62.2P, *Ventilation and Acceptable Indoor Air Quality in Low-Rise Residential Buildings*, which would consist of a few independent substantive changes. Comments focused on issues such as sound ratings for kitchen and bathroom fans and backdraft testing of combustion appliances.

LBNL Reports.

(1) **Apte, M.G. and Erdmann, C.A. 2002.** *Associations of Indoor Carbon Dioxide Concentrations, VOCs, and Environmental Susceptibilities with Mucous Membrane and Lower Respiratory Sick Building Syndrome Symptoms in the BASE Study: Analyses of the 100 Building Dataset*, Lawrence Berkeley National Laboratory, Berkeley, CA, LBNL-51570. The analyses results include statistically significant associations of higher carbon dioxide concentrations with mucous membrane (MM) and lower respiratory system (LResp) SBS symptoms, adjusting for age, gender, smoking status, presence of carpet in workspace, thermal exposure, relative humidity, and a marker for entrained automobile exhaust. In addition, the analyses found statistically significant dose-response relationships between CO₂ concentrations and four SBS symptoms. Adjusted odds ratios were 1.1 to 1.2, implying approximately a 10% to 20% increase in prevalence, per 100 ppm increase in CO₂ concentration. The analyses of the linkage of VOCs with symptoms utilized both individual VOCs and groups of correlated VOCs identified in principal component analyses and tentatively linked to VOC sources. The analyses also identified statistically-significant associations of SBS symptoms with concentrations of selected individual VOCs and with some of the groups of correlated VOCs, and provided some evidence that chemical reactions between ozone and terpenes may create new pollutants that contribute to symptoms.

(2) **Mendell, M.J. and Cozen, M. 2002.** *Building-Related Symptoms Among U.S. Office Workers And Risks Factors For Moisture And Contamination: Preliminary Analyses Of U.S. EPA BASE Data*. Lawrence Berkeley National Laboratory Report, LBNL-51567, Berkeley, CA. Another study of the EPA BASE data examined the relationships of SBS symptoms with indicators of contamination or maintenance quality in HVAC systems, with moisture problems in buildings, and with space-cleaning practices. The analyses to date controlled for potential confounding by personal and job-related factors, but not for other environmental factors. Significantly elevated odds ratios (ORs) for mucous membrane symptoms were associated with the following risk factors: presence of humidification system in good condition versus none (OR = 1.4); air handler inspection annually versus daily (OR = 1.6); current water damage in the building (OR = 1.2); and less than daily vacuuming in study space (OR = 1.2).

Significantly elevated ORs for lower respiratory symptoms were associated with: air handler inspection annually versus daily (OR = 2.0); air handler inspection less than daily but at least semi-annually (OR=1.6); less than daily cleaning of offices (1.7); and less than daily vacuuming of the study space (OR = 1.4). Only two statistically significant risk factors for neurologic symptoms were identified: presence of any humidification system versus none (OR = 1.3); and less than daily vacuuming of the study space (OR = 1.3). Dirty cooling coils, dirty or poorly draining drain pans, and standing water near outdoor air intakes, evaluated by inspection, were not identified as risk factors in these analyses, despite predictions based on previous findings elsewhere, except that very dirty cooling coils were associated with a non-significant increase in lower respiratory symptoms.

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(3) **Fisk, W.J.; Faulkner, D.; Sullivan, D.P.; and Delp, W. 2002.** *Measuring Rates Of Outdoor Airflow Into HVAC Systems*. Lawrence Berkeley National Laboratory Report, LBNL-51583. Berkeley, CA. Laboratory-based studies indicate that the first measurement technology evaluated can provide a reasonably accurate measurement of OA flow rate over a broad flow range, under conditions without wind. The measurement of OA flow rate was accomplished with minimal increase in airflow resistance. It was also found that the test system and protocol developed for this project provides a convenient and accurate method of evaluating the accuracy of technologies for measuring outside air flows into air handling systems. However, further research is needed to develop systems and protocols for assessing the influence of winds on measurement accuracy.

Publications.

(1) **Seppanen, O. and Fisk, W.J. 2002.** *Association Of Ventilation System Type With SBS Symptoms In Office Workers*. Indoor Air 12(2): 98-112. LBNL-47457. A review of the association of ventilation system type with SBS symptoms in office workers, performed by Helsinki University of Technology and LBNL, was published in Indoor Air. The major finding is a nearly consistent association of air conditioning with increased SBS symptoms.

(2) **Zhao, D.; Little, J.; and Hodgson, A. 2002.** *Modeling The Reversible, Diffusive Sink Effect In Response To Transient Contaminant Sources*, Indoor Air 12 (3): 184-190. This is a paper on the VOC sorption and desorption processes.

HUD - U.S. Department of Housing & Urban Development, Ellen Taylor

Next week, HUD will announce their list of grantees. HUD will award 12 grants at a total of \$8 million.

NIST and HUD are sponsoring a workshop together on October 30 and 31. This is a two-day workshop on mold and moisture control targeted to houses. The workshop will be held on the NIST campus. If you are interested in attending, please contact Ellen Taylor, ellen_r_taylor@hud.gov for an invitation. You must have an invitation to attend this workshop in order to be admitted onto NIST's campus. They require prior notification for security purposes.

EPA - Indoor Environments Division (IED), Mary Smith

- (1) *Mold, Moisture, and Your Home* was released and published. EPA provided copies of this document to all meeting attendees. This publication is targeted to homeowners and their related mold questions. EPA's Web site is flooded every day with requests for mold document. EPA is currently working on a more detailed version of this document. Laura Kolb (202.564.9438) is heading up this effort. To review the document, please contact Laura Kolb directly, laura.kolb@epa.gov. The University of Connecticut is working on a clinician's guide to mold.
- (2) EPA and a contractor are currently working on a Web-based training module for mold.
- (3) An EPA success is the fact that the National Fire Protection Association's NFPA 5000 National Building Code 2003 Edition includes provisions for radon resistant new construction standards (RRNC) within the body of the document (Chapter 49, Section 49.2.5, p.356). Among other requirements for jurisdictions adopting the code, is that RRNC is mandatory in Zone One high radon potential areas, and the passive vent pipe is labeled to encourage testing by occupants/owners.
- (4) The Office of Homeland Security and EPA created a "Building Air Protection" manual. This manual is based on office buildings but can also be adapted to schools. NIOSH is the primary author of this

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- document. The next document will be a filtration document, an effort that NIOSH will also be leading.
- (5) EPA is leading an effort to research proper cook stove ventilation and use internationally. The so-called “cookstove initiative” was one result of the August-September 2002 UN Summit in Johannesburg (SA) on the Environment and Development.
 - (6) EPA welcomes Elizabeth Cotsworth as the new Director of the Office of Radiation and Indoor Air (ORIA). Previously, she had held various management positions in EPA’s Office of Solid Waste.

NEXT CIAQ Meeting: Wednesday, January 22, 2003 from 1:00 to 3:30 pm, at Judiciary Square, Visit the CIAQ website for details, www.epa.gov/iaq/ciaq/index.

~ PRESENTATION ~

Indoor Air Quality Design Tools for Schools

Bob Axelrad

EPA Indoor Environments Division

IAQ Design Tools for Schools

- Draft version of new, voluntary, Web-based guidance for design, construction, renovation, and operations and maintenance of new and renovated school facilities
- Complements *IAQ Tools for Schools* guidance for existing schools
- Promotes IAQ in the context of high performance schools

High Performance Schools

Whole-building, integrated design to improve performance while protecting occupant health and saving money, energy, and the environment

- Characteristics of a high performance school
- Benefits of a high performance school
- Financing high performance schools
- Key questions and answers about high performance schools

Why Design Guidance?

- Design decisions directly affect student and staff exposure to contaminants
- Construction practices play a critical role in moisture control
- 53 million children and 2 million adults spend their days in the nation's 110,000 K-12 schools (U.S. Census Bureau, 2001)
- 6,000 new schools will need to be built in the U.S. by 2007 (U.S. NCES, 2000)
- Controlling moisture and outdoor and indoor pollutant sources can prevent:
 - Exposure of children and staff to mold and other allergens, particles, volatile organic compounds (chemicals), pesticides, and gases (e.g., radon, carbon monoxide)
 - Respiratory illnesses including asthma (most frequent cause of absenteeism due to chronic illness—causes more than 10 million missed school days per year), allergic reactions, and a variety of others
- Providing proper ventilation improves concentration and learning
- Repercussions of poor school design and construction practices include:
 - Direct impacts on children's health
 - Reduced student performance
 - Higher energy costs
 - Loss of funding tied to attendance
 - Possible school closings—both temporary and permanent
 - Potential liability

Major Components of *IAQ Design Tools for Schools*

- Introduction
- Pre-Design
- Heating, Ventilation, and Air-Conditioning (HVAC)

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- Controlling Pollutants and Sources
- Moisture Control
- Construction
- Commissioning
- Operations and Maintenance
- Renovation and Repair
- Portable Classrooms

Links by Topic

- | | |
|--|--------------------------------|
| • Acoustics | • Integrated Pest Management |
| • Asbestos | • Life Cycle Costing |
| • Asthma | • Lighting |
| • Cleaning | • Lead |
| • Commissioning | • Legislation |
| • Construction | • Mercury |
| • Diesel School Buses | • Mold |
| • Emergency Preparedness | • Organizations |
| • Emissions Testing and Guidelines | • Performance |
| • Energy Efficiency | • Pesticides |
| • Environmental Assessment Tools | • Renovation |
| • Environmental Education | • Research Siting |
| • Facility Issues | • U/V Radiation |
| • Financing | • U.S. Department of Education |
| • Green/Sustainable Products and Buildings | • Ventilation |
| • High Performance Schools | • Waste |
| • Indoor Air Quality | |

Pre-Design

- Planning, Programming, and Goal Setting
- School Site Selection and Evaluation
- Selecting the Architectural and Engineering Team
- References and Additional Sources of Information

Pre-Design: School Siting

Examples of Recommendations:

- Provide opportunities for participation in the school site acquisition process by school administrators and staff, parents, age-appropriate students, and community members
- Prior to site acquisition, complete a Phase I Environmental Site Assessment using [ASTM Standard Practice E1527-00](#)
- Ensure that the soil contamination is cleaned up or avoid site

Pre-Design: Selection of the Team

Examples of Recommendations

- Select a design team with necessary qualifications for designing a high performance school, and include the requirements for a high performance school in the negotiated design services

- Communicate goals to designers
- Ask prospective design team to answer specific IAQ-related questions

Heating, Ventilation, and Air-Conditioning (HVAC) Systems

Key Areas Covered:

- Codes and Standards
- Potential for Natural Ventilation and Operable Windows
- Selection of HVAC Equipment
- Location of Outdoor Air Intakes and Exhaust
- Outdoor Air Quality
- Ventilation Controls
- Humidity Control
- Air Distribution
- Exhaust Air
- Designing for Efficient Operations & Maintenance
- Commissioning

Examples of Recommendations:

- Consider the use of natural ventilation and operable windows to supplement mechanical ventilation
- Where feasible, utilize central HVAC air-handling units that serve multiple rooms in lieu of unit ventilators or heat pumps
- Consider specifying energy recovery ventilation equipment
- Comply with ASHRAE-62 and Addenda
- Locate outdoor air intakes away from pollutant sources and prevent blockage
- Seal air ducts to prevent HVAC system air leakage
- Pay special attention to preventing moisture from entering duct work
- Provide exhaust ventilation for janitors' closets, copy/work rooms, arts and crafts preparation areas
- Ensure that all system components, including air handling units, controls, and exhaust fans, are easily accessible

School Advanced Ventilation Engineering Software (SAVES)

- Free software in the Tool Box
 - ERV Financial Assessment Software Tool (EFAST)
 - Helps building designers, engineers, ventilation contractors and school officials decide whether energy recovery ventilation (ERV) systems would be cost effective in new schools or as retrofit
 - Indoor Humidity Assessment Tool (IHAT)
 - Evaluates the impacts of various design strategies on indoor humidity levels in schools (including ERVs)
- www.epa.gov/iaq/schooldesign/saves.html

Controlling Pollutants and Sources

- Keeping outdoor sources out
 - Radon barriers
 - Sewer gas barriers
 - Entry mat barriers
 - Shell penetration barriers

- Location and protection of air intakes and exhaust
- Controlling indoor sources
 - Material selection (pre-construction)
 - Installation sequencing
 - Material minimization
 - Material encapsulation
 - Ventilation techniques
 - Flush out and air out
 - Exhaust or spot ventilation
 - Air cleaning

Moisture Control

- Building materials
- Precipitation
- Construction cavities
- Moisture in ventilation air
- Energy recovery ventilators
- Summer humidity
- Condensation

Examples of Recommendations

- Keep building materials dry during construction
- Dry water damaged materials within 24 hours
- Proper installation of vapor barriers
- Insulate to minimize condensation

Construction

- IAQ Management During Construction Planning
- Construction Practices
- References and Resources

Commissioning

Pre-occupancy check to make sure systems are operating as they were designed

- Commissioning Agent
- Cost of Commissioning
- IAQ Commissioning Checklist
- Resources and References

Operations and Maintenance

- Design for easy operations and maintenance
- Obtain, adapt as needed, and implement EPA's IAQ Tools for Schools Program and Kit
- Recommend that an "Owners Manual" be developed and maintained at the school
- Provide training to school staff appropriate to their roles
- Checklist on the Web site

Renovation and Repair

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- Timing
- Distance
- Barriers
- Containment
- Clean-up
- Renovation and Repair Checklist

Portable Classrooms

- Common problems
- Poorly-functioning HVAC systems that provide minimal ventilation with outside air
- Poor acoustics from loud ventilation systems
- Chemical off-gassing from pressed wood and other high-emission materials, compounded by quick occupancy after construction
- Water entry and mold growth
- Site pollution from nearby parking lots or loading areas
- Specifying new portable classrooms
- Operations and maintenance
- Commissioning

Next Steps

- Formal public comment period closed July 19, 2002
- Comments now being integrated
- Final posted late 2002
- Suggestions still welcome
- <http://www.epa.gov/iaq/schooldesign/start.html>

The Big(ger) Picture:

EPA Healthy Schools Initiative

- President's Task Force Schools Workgroup
- Healthy School Environments Web Portal
www.epa.gov/schools
- Senate Environment & Public Works (EPW) Green Schools Hearing October 1
- Pilot projects:
 - Evaluate barriers to high performance schools
 - Regional Environmental Management Systems Pilots (Regions 1 & 5)
 - Health and Safety Assessment Tools

President's Task Force On Environmental Health Risks And Safety Risks To Children

- Established by Executive Order
- Co-chaired by EPA Administrator Christine Todd Whitman and Secretary of Health and Human Services, Governor Tommy Thompson
- Asthma & Lead Strategies
- Schools Workgroup created October 2001 (DoED, CDC/DASH, EPA co-chairs)
 - Inventory
 - Strategy

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Increased collaboration

New Healthy School Environments Web Portal

Now available

- “One-Stop” Access to On-line Resources on School Environmental Health
- www.epa.gov/schools

For more information, contact Bob Axelrad (202.564.9315, axelrad.robert@epa.gov).

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Attendees

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Matt	Gillen	NIOSH/CDC	202.401.2193	mgillen@cdc.gov
Cindy	Howard Reed	NIST	301.975.8423	chreed@nist.gov
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